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The Extension Pathologist

"TO PROMOTE ECONOMIC CROP PRODUCTION,
IMPROVE THE QUALITY OF PLANT PRODUCTS, AND
REDUCE WASTAGE IN STORAGE, TRANSIT, AND AT THE MARKET"

EXTENSION WORK IN PORTO RICO

RAILROAD AGRICULTURISTS INTERESTED IN PLANT DISEASES

WHAT ARE MARKET DISEASES

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THE EXTENSION PATHOLOGIST

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Contents of This Issue.

	Page.
EXTENSION WORK IN PORTO RICO.	52
RAILROAD AGRICULTURISTS INTERESTED IN PLANT DISEASES.	55
WHAT ARE MARKET DISEASES?	56
PRIZE FOR TREATING SEED WHEAT	61
EXTENSION SERVICE HANDBOOK.	61
WITH THE STATES	
Iowa.	62
Kansas, Minnesota, New York.	63
North Carolina, Pennsylvania	64
Virginia, West Virginia	65

EXTENSION WORK IN PORTO RICO

By M. F. Barrus, Extension Professor of Plant Pathology,
New York State College of Agriculture. *

Porto Rico is an island about 100 miles long by 40 miles wide and is the easternmost one of the Greater Antilles. It has an area of 3,425 square miles, the greater part of which is mountainous, several peaks rising to a height of 4,000 feet or more. The mountains, for the most part, are covered with soil of a reddish clay or sandy-clay which is very tenacious. Except at eastern and western points, the area near the coast and extending back a few miles is relatively level or rolling, with some hills, and the soil is sandy to sandy-clay in character.

In 1919, 92 per cent. of all land of the island was in farms of which 64.5 per cent, was improved, the remainder being wood or waste land. The principal crops in order of importance are sugar-cane, tobacco, coffee, and fruits. The fruits include oranges, grape-fruits, citrons, bananas, plantains, pineapples, mangoes, avocados, and many other tropical kinds. Among other crops of importance are coconuts, Sea Island cotton, sweet-potatoes, yams, yautias, and rice. Vanilla, ginger, and Irish potatoes are grown to some extent. Such vegetables as cabbages, peppers, eggplant, tomatoes, beans, carrots, beets, lettuce, and swiss chard are being grown in increasing quantities every year.

Plant Diseases Affect Many Crops.

The diseases affecting these plants in Porto Rico are largely the same as occur in other places where they are grown. The most important diseases are mosaic and gummosis of sugar-cane; damping-off and mosaic of tobacco; Rosellinia root rot of coffee; scab of citrus; wilt of bananas; anthracnose of mango; bud rot of coconut; mal de yautia; Cercospora leaf-spot of cotton; Helminthosporium spot of rice; bacterial wilt of eggplant, pepper and potato; and Cladosporium leaf-spot of tomato. It may be of interest to know that late-blight of potato occurs here and has caused considerable damage in at least one field. There are many other diseases that may become of importance later or may even be so now if they were better understood. There are diseases the causes of which are not known. The field is rich for the investigation of the many disease problems that exist. Much is being done by the pathologists at the two Experiment Stations, but they can make only a beginning.

Extension Work Carried On.

The first important extension work for the control of diseases was that done on sugar cane mosaic. Ten years ago this disease was causing a material loss to the growers. Those in the western end of the island

* Dr. Barrus is spending the year with agricultural workers in Porto Rico.

especially were greatly disturbed by the situation. At first the extension agents were engaged in roguing affected plants from the fields. When this was found to be ineffective, attention was turned to the production of clean seed in seed-beds and to testing new varieties for resistance. Fortunately at this time, Uba cane was found to be immune to mosaic and this variety was introduced to growers through the agency of the Insular Department of Agriculture and Labor. Within a few years it had largely supplanted other varieties in the western part of the island and with its use the yield of sugar began to increase. In the southern part of the island, new varieties, such as B.H 10-12 and Santa Cruz 12-4 replaced the older ones. These are not immune to mosaic, but are somewhat tolerant of it and this quality, combined with their higher yielding properties and higher sugar content, has resulted in an increased sugar production far beyond what had ever been obtained before.

The experiment stations and extension forces working together to introduce new varieties, to test their qualities in several localities, to carry on breeding work, to increase the seed of the better varieties, and to distribute it to growers have brought about a revolution in cane varieties that has resulted in the most remarkable increase in yield that has ever been witnessed here in any crop. The sugar cane mosaic, instead of being a scourge, proved to be a blessing by compelling the discovery and adoption of better varieties.

When the gumming disease was discovered to be causing a disastrous reduction in yields in the eastern end of the island, the same efforts were made to control it. Now the affected fields are planted with those newer canes which were discovered to be resistant to this disease. Because of the better yielding qualities of these canes as well as their resistance, the yield of sucrose per acre has greatly increased. The Plasmodiophora disease was also controlled by the use of resistant varieties.

About six years ago coconut bud rot was discovered in groves of the Mayaguez section. A survey revealed that the disease existed in many groves in the western part of the island. It was a serious situation because all the groves throughout the island were endangered. An investigation of the disease was begun by the Federal Experiment Station where it was later discovered that the disease also affected the date palm. In the meantime the Department decided upon a campaign of inspection of groves and eradication of affected trees. The agricultural agents of the affected districts concentrated upon this work, at first under the supervision of the pathologist of the Federal Experiment Station and later under a man detailed for the work from the Department. As a result of these measures the disease has been kept confined to the western end of the island, and the infection there is being gradually stamped out.

An extension specialist in tobacco is employed by the Department who is giving, with the assistance of the agricultural agents, some attention to the control of damping-off of tobacco. Demonstrations in the control of this disease form a part of the work of the agents every year. A pathologist of the Insular Experiment Station is employed in cooperation with the Porto Rico-American Tobacco Company to investigate this and other tobacco diseases and the results of this work will be utilized for extension as fast as they are available.

Banana wilt has been very troublesome to the growers here, especially as their most excellent variety -- the Gigante -- is very susceptible. The extension agents have endeavored to help the growers by advocating such control measures as the use of clean seed and of clean soil, but these did not help materially. This variety has gradually disappeared to be replaced by more resistant ones.

There are other and more minor disease problems with which the extension force deals, but those described will give an idea of the nature of the work accomplished. The extension and investigational agencies work closely and harmoniously together for the prompt solution of plant disease problems of Porto Rico.

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The Need of Railroad Agricultural Departments for more Information
on Diseases of Fruits and Vegetables as they occur during
the Marketing Period. *

By William F. Turner, Horticultural Agent,
Central of Georgia Railway Company.

The railroads of the United States and Canada handle over a million cars of fruits and vegetables, annually; a tonnage valued at many hundreds of millions of dollars. This type of tonnage is highly perishable, requiring more care and more special treatment than any other freight; principally because of its susceptibility to disease attack in the field, in storage and in transit. It is the only type of traffic which, following several years of special attention and continued effort, has not shown itself to be amenable to improvement in the prevention of loss and damage as evidenced by the filing of claims.

Railroads handling perishables are faced with a two-fold problem: (1) the elimination of disease injury during transit, a problem which still needs the study and thought of trained pathologists, and (2) a more definite knowledge of specific causes in individual cases of damage, so that the true responsibility for the injury may be determined.

The direct handling of these problems must continue in the hands of men who are not, and cannot be, trained pathologists. They can only be solved by a closer cooperation between transportation employees, charged with this work, and Federal and Experiment Station pathologists.

- * Abstract of paper presented December 28, 1927, at Extension Session, Annual Meeting of the American Phytopathological Society, in Nashville, Tennessee.

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WHAT ARE MARKET DISEASES?

By D. H. Rose, Physiologist, U. S. Department of Agriculture. *

Market diseases of fruits and vegetables, as the name indicates, are those which occur during the process of marketing. They are not necessarily different from those which occur during the growing of the various crops; though as the tentative classification to be given below will indicate, some of those which are common and destructive during the marketing process are relatively unimportant in the field. Taken as a group, they constitute one of the major problems which must be dealt with during the movement of perishables from grower to consumer.

For the purposes of this discussion the term disease will be used to designate any condition except insect injury which causes deterioration in the quality and condition of fruits and vegetables. Consequently it will cover such widely different conditions as apple black rot, potato scab, fig sunburn, and apple scald. The first two of these are caused by parasitic fungi, the third by conditions under which the product is grown, and the fourth by storage conditions and the life processes of the product itself.

A classification of such diseases which has proved serviceable in many ways during the growth and development of the federal inspection service is as follows:

1. Diseases which are important in the field and on the market but are not able to develop or spread during the processes of marketing.

Examples: Potato scab, peach and apple scab, cucumber and tomato mosaic.

2. Diseases which are important in the field and are able (a) to develop or (b) to develop and spread during the processes of marketing.

Examples: (a) Phoma rot of tomatoes, stem-end rot of citrus fruit; (b) peach brown rot, watery soft rot (Sclerotinia rot) of vegetables especially celery, lettuce and carrots.

3. Diseases which are important in the field and which open the way for the entrance of secondary rots.

Examples: Scab of apples opening the way for pink mold rot; tomato nail-head spot opening the way for Phoma rot.

* Paper prepared for Extension Session, Annual Meeting of the American Phytopathological Society, Nashville, Tennessee, on December 28, 1927.

4. Diseases which develop and spread during the processes of marketing and are intimately associated with them.

Examples: Rhizopus rot of many fruit and vegetables, blue mold rot of apples, grapes, etc.

Incidental mention has been made of some of the causes of market diseases. If it be desired to consider these in more detail, the following classification and discussion will serve to bring out the more important facts.

Causes of disease in fruits and vegetables during the marketing process:

1. Causes inherent in the product -
 - a. Water loss.
 - b. Respiration and digestion.
2. Causes external to the product -
 - a. Non-living
 - (1) Low temperature.
 - (2) High temperature.
 - (3) Oxygen supply.
 - b. Living
 - (1) Fungi and bacteria
1. Causes inherent in the product -
 - a. Water loss. Practically all of the plants or plant parts that comprise the group known as perishables have a high water content. Perishables are not very effectively protected against loss of water and therefore are continually giving it off in the form of vapor to the surrounding air. If this water loss becomes rapid or goes on for a long time even though slowly, the plant tissue shrivels or wilts. A good deal of the so-called normal shrinkage of fruits and vegetables is due to water loss. Potatoes or apples kept in the field too long before loading or storing held in storage too long or in storage places that are too dry are likely to become flabby and of poor quality. Spinach and lettuce shipped under ventilation often arrive in a wilted condition which detracts seriously from their appearance and reduces their market value. A moderate amount of drying is often desirable, however, since it prevents the growth of fungi and bacteria present on these surfaces.
 - b. Respiration and digestion. In addition to giving off water vapor, plants give off heat and a gas, carbon dioxide. These are liberated in the process known as respiration and are roughly comparable to the burning of wood or coal in a furnace. The process requires air, that is, oxygen, just as

a flame does. The heat liberated in this process is responsible for the so-called heating of perishables.

2. Causes external to the product -

a. Non-living. Of these, the most important are temperature and oxygen supply which affect the inherent processes of plant tissues, such as water-loss, respiration and digestion.

(1) Low Temperature. The most important effect of low temperature upon perishables is freezing injury. If the freezing is severe the product is killed and becomes badly discolored; if mild the product is not entirely killed and suffers only local death and discoloration as in potatoes showing freezing necrosis.

Freezing injury may result from low temperature acting in conjunction with delay in transit and defective equipment or from outside temperatures so low that no equipment at present in use would, without the use of heaters, furnish adequate protection against them. Freezing injury may also result from salting the ice in cars which do not have false floors and insulated bulkheads. It should be remembered that mere exposure to low temperatures is not sufficient to cause serious injury. The length of exposure is also an important factor.

Temperatures not low enough to cause ice formation may still be so low as to derange the normal life processes of certain products and bring about discoloration or other deterioration in quality. Frequently products exposed to such temperatures do not ripen properly and are very susceptible to decay.

(2) High Temperature. The rate at which the ripening processes in plant tissues go on is greatly influenced by temperature. Not all products, however, are influenced equally by the same temperature. At high temperature it is very rapid while at low temperatures it may be quite negligible. For this reason products are refrigerated. The effect of poor refrigeration - in transit - on the ripening process is well illustrated by the condition of the top of the load, in cars of western cantaloupes and of Bartlett pears from California or the Northwest. Cases are frequent where the pears or cantaloupes on inspection at destination, are found overripe in the top layer of packages, firm ripe in the next and hard green or at least in good commercial in the remaining layers. Such a condition may be due to poor icing, to a defective car or to such close stowing that proper circulation of air through the load is impossible. It is essential that equipment be obtained and a system

of refrigeration be established which will minimize the difference in temperature between the top and bottom of the load. Until this objective is attained, cars should not be loaded so high that the top layer cannot be refrigerated effectively. Even under present conditions of car shortage it is doubtful if much is gained by loading so heavily that part of the load is damaged because of poor refrigeration.

Fruits and vegetables may ripen very rapidly under conditions of high temperature produced (1) by their own life processes or by those of the fungi which attack them, (2) by heaters, in cars moving under option during the winter or, (3) by high outside temperatures. If in addition to high temperature there is an inadequate supply of air, ripening and other kinds of deterioration will go on still more rapidly. This brings up the question of ventilation and its close connection with temperature and other conditions surrounding perishables in transit and in storage.

- (3) Oxygen Supply. It is important that the space in which perishables are held be well supplied with fresh air or that the air be kept moving, so that the oxygen which is necessary for respiration may be always available, and water or harmful gases may be removed. Sometimes a real lack of oxygen, at normal temperatures, is responsible for rapid and complete deterioration. Very frequently, however, a shortage of oxygen exists because the normal amount in the air is insufficient to keep a fruit or vegetable well supplied, at the high temperatures to which it is exposed. For example, if apples are shipped under conditions where ventilation is good, but the temperature extremely high, oxygen is consumed more rapidly than it can be supplied from the surrounding air and the apples are forced to obtain it from their own tissues. The results is browning and internal break-down, a condition generally known as "cooked". Potatoes moving in heated cars or in cars not heated but poorly ventilated also suffer from lack of oxygen and by their own respiration destroy their own tissues. The condition produced is black heart.

Apples held in storage with ventilation, that is, in tight containers, in containers packed too closely together or in storage places where no air circulation is provided are likely to be damaged by scald. This condition is brought about by harmful gases produced by the fruit itself which accumulate close around it unless carried away by air currents. The scald may not be apparent in storage if the temperature has been held at 32° F., but is latent or potential and will appear within three to five days after removal of the fruit to a temperature ten to twenty degrees higher.

b. Living.

(1) Fungi and bacteria. The most serious deterioration of perishables, often referred to as "excessive shrinkage" is caused by fungi and bacteria. These are not able in most cases to make their own food but must obtain it from other plants or animals.

In plants, disease may occur as (1) blemishes - potato scab, apple scab, (2) rotten spots of different sizes - apple black rot, potato Fusarium tuber rot, (3) leaky, mushy condition involving the whole plant or plant part - watery soft rot of celery, Rhizopus rot of strawberries.

Whether or not and to what extent disease develops or spreads in transit depends upon the nature of the fungus or bacterium which causes it and upon the condition of the product when loaded. It depends also upon conditions in the car or in storage, particularly moisture and temperature. If the product is loaded or put in storage or becomes wet (sweated) from water given off by its own tissues, conditions are favorable for the growth of parasitic fungi and bacteria. If, in addition the temperature is fairly high, above 50 degrees Fahrenheit, the growth of fungi and bacteria is favored even more and decay goes on very rapidly. This in turn increases the respiration of both plant and parasite, heating and sweating are increased and a vicious circle is set up wherein all factors work together to complete the destruction of the product.

Whatever the extent to which disease develops, the plants or plant parts affected are usually so damaged in appearance or so badly rotted that their keeping quality is impaired, and their food and market value seriously reduced.

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* PRIZE FOR TREATING SEED WHEAT *
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* Editorial in Grain Dealers Journal, Feb. 10, 1928. *
*
* "Here is a new and a good one. A Pennsylvania *
* grain commission merchant offered a silver loving cup to *
* the person in a nearby community rendering the greatest *
* service to the community, and it was given without hesi- *
* tation to George Weaver of Millersburg, for having treated *
* the largest number of bushels of seed wheat for stinking **
* smut, and doubtless his farmer patrons were glad he won *
* the cup. He won because they won." *
*

EXTENSION SERVICE HANDBOOK

During 1927 a loose-leaf Extension Service Handbook was issued for use of the extension workers in the field and the department staff here in Washington, D. C.

This book contains a section on "Plant Diseases." It gives general information concerning plant diseases and their control, a synoptic treatment of the more important diseases, and detailed information on the preparation and use of the common fungicides.

There are a limited number of handbook fillers on hand and if there are any pathologists who could use the book, the Office of Cooperative Extension Work would be glad to give consideration to supplying requests.

The loose-leaf leather binder for the filler may be purchased from the Sieber Products Manufacturing Company, 4000 Laclede Avenue, St. Louis, Mo., at \$1.25 each. The factory order of the binder is 12595.

WITH THE STATES

Iowa.

The principal project that is receiving attention this spring is the one on corn disease control. We are emphasizing several phases of this project for the successful control of dry rots of corn as follows:

1. Early field selection of seed.
2. Artificial drying of the seed as soon as gathered.
3. An individual ear test of at least 100 ears to determine the percentage of strong germination. Whenever possible all corn should be tested.
4. Seed treatment of all corn with either Merko, Bayer Dust or Semesan, Jr.
5. Crop rotation where corn is grown only one year in the rotation scheme.

Tests since December on over 12,000 ears of early and late selected seed have shown that in every case where the seed has been properly cared for, the early selected has a higher percentage of strong germination, fewer dead kernels and less mold than the late selected of the same variety from the same field. Corn dried with artificial heat at a temperature not lower than 100° F. has shown stronger vitality and less mold than naturally dried seed. This relationship held true regardless of the time the corn was selected.

Test plots using chemical dusts will be carried out in 1928 in over 30 counties of the state on different soil types, on soils with different amounts of fertility and on new land and old land. The Iowa Experiment Station Circular No. 108 entitled "Seed Treatment for Corn Diseases" issued in January of this year summarizes the results of previous years and of county tests on farmer's planter box corn in 1927. The results have been so satisfactory that we are endorsing seed treatment of corn for all seed but we emphasize the importance of using every other known method of securing disease free corn with strong germination. Seed treatment is only an added form of cheap insurance to aid in making for more efficient corn production.

In the State Yield Test in 1927 when we treated several samples of nearly disease free corn the yield was boosted in nearly every case. One sample untreated took eighth place, the treated sample took first. In another district the untreated sample took 15th place, the treated was above everything else showing an increase of 8 bushels per acre.

We are also doing some special seed treatment work with small grains and with potatoes.

R. H. Porter

Kansas

The District Wheat Growers Schools held in Kansas last January are now being reflected in the interest taken by the local leaders who attended the District Schools. These local leaders are now helping to hold the County Crop Improvement Schools. They are unusually successful in getting their neighbors to the meetings this spring.

These trained local leaders help two ways in conducting the smut control program. In some counties they take charge of the charts and the compound microscope and go through the entire life history and control of the organism. In other counties they ask questions which are especially helpful in bringing out important points in the discussion.

C. E. Graves

Minnesota

When checking up on wheat smut it has been our practice here to send out circular letters to all grain elevators about the middle of winter, asking them what changes, if any, have been observed in the amount of smutty grain being delivered. In the questionnaire which we use, we ask whether the amount of smutty grain has increased or decreased, or is the same as the previous year. This gives us some idea as to where the following season's work should be directed. I also got as many of the elevators as possible to send in lists of farmers who delivered smutty grain. We use these lists in mailing out complete information on methods of treating. In localities where smut is extremely bad, we are using smut tags which are fastened to the cream cans that are returned to the farmers from the creameries. These tags are a little larger than the ordinary shipping tag, are bright red in color, and call attention to the smut conditions in the community and methods of control. When the farmer finds this tag attached to his cream can, he usually reads it after untying it from the cover. The effect of this method of publicity will be checked up later.

R. C. Rose

New York

Potato spray rings are increasing in number more than three hundred per cent. over last year.

Approximately 100,000 bushels of seed potatoes will be treated this spring with the hot corrosive sublimate solution in community treating vats.

Pickle growing is reviving in up-state sections, and the contractors are cooperating with the Pathology Department and the county agricultural agents in treating all the seed before it is distributed among the farmers.

The fruit spray service is again being conducted in fourteen counties. The men hired for this work appear to be a very promising lot. They were put through a heavy schedule during the week of the "Special Field Assistants' School". The school has become so popular that many agricultural agents and other workers attend. Many farmers made application to attend, but because of the nature of the work they were refused admittance.

Dr. M. F. Barrus, our genial director of Extension Work, is still lolling the palm shade of Porto Rico. Here's hoping that a cocoanut will not fall on his head before he returns to relieve his perspiring assistants.

Charles Chupp

North Carolina

Following a series of tobacco meetings attended by about two thousand tobacco growers in February, special attention has been given to sweet potato diseases for the past several weeks.

Meetings have been held in storage houses at Kings Mountain, Shelby, Grover, and Lattimore at which specimens of the various diseases were observed and their control was discussed. Eight additional meetings were held this season at which illustrated lectures on sweet potato diseases were given to the growers by Doctor Poole. Much interest was shown at these meetings, which were attended by an average of approximately forty sweet potato growers at each.

Where meetings were held in storage houses, an effective means of pointing out the importance of the control of scurf was employed by calling to the growers' attention baskets filled with scurfed and healthy potatoes. The unattractive appearance on the market of baskets containing even a few visible scurfed potatoes ~~was~~ pointed out.

This season storage house associations at Shelby, Ellenboro, and probably Lattimore, as a result of losses from disease will store only potatoes coming from treated seed. At Shelby, the seeds are being treated by the house operator, Mr. L. F. Harmon, as the seeds are taken from the house by the growers. In addition to the treatment of the seed, the disinfection of houses with formaldehyde before storing is being practiced in all houses visited.

G. W. Fant

Pennsylvania

At Penn State early in March a new type of farmers' spray

service school was brought to a close. We had about sixty farmers in attendance but would have had quite a few more if we had not had to turn down applications on account of having limited equipment. It was interesting to see these farmers picking perithecia out of scabbed apple leaves and studying stages of development under the microscope. In fact many of them were so interested that, after six hours of the regular laboratory work, they asked for an extra session and came back and worked for two extra hours picking out perithecia. I feel certain that these fruit growers got a new conception of the workings of scab and the plans of the Extension Pathologists to help them with the spray service in the various counties.

R. S. Kirby.

Virginia

In checking over the results obtained by planting a resistant variety, Wisconsin All Seasons cabbage, for the prevention of cabbage yellows, *Fusarium conglutinans*, I find that splendid results have been obtained. In Augusta County, where cabbage is only grown as a family garden proposition, Mr. J. B. Hodges, P. R. Weast, and J. C. Weast, all of Harriston, had for years experienced trouble with growing cabbage. Finally yellows became so bad they had to discontinue growing this crop. They obtained some of the above named resistant variety of cabbage seed and had a perfect stand, while all the other varieties planted in the same garden failed. W. H. Irving, Millboro, had similar results. W. H. Runkel, Waynesboro, has been having trouble for years. He obtained some of the resistant seed which made a perfect crop while he lost all of the other varieties planted. This shows beyond a doubt the value of Wisconsin All Seasons Cabbage as a resistant variety of cabbage yellows.

This same kind of seed is being used on a much larger scale for the commercial crop in Southwest Virginia with apparently good results. A new improved market variety, resistant to *Fusarium*, is being tried this year.

S. B. Fenne

West Virginia

At Farmers' Extension schools held during February and the first part of March thirty-six talks were given. For the most part these talks were discussions of methods for combatting foliage and seedborne diseases of potatoes. Addresses were also given at meetings of the Berkeley County, Morgan County, and Hampshire County Fruit Growers Associations, and the State Horticultural Society. At these meetings the apple spray program for 1928 was discussed. The latter part of March was devoted to orchard spray service work. This work will be

continued during April, May and part of June. The principal features of this service to the fruit growers relates to the modifications of the basic program and the timing of the sprays according to seasonal conditions.

E. C. Sherwood

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Articles, news notes, or suggestions with regard to subjects that might profitably be discussed in this news sheet, should be addressed to:

F. C. Meier,
~~Extension~~ Plant Pathologist,
Bureau of Plant Industry,
U. S. Department of Agriculture,
Washington, D. C.

